watermark area of said digital data contents;

calculating the number k_i of '1' or '0' included in said digital watermark sequence;

calculating a probability $F(k_i)$ by using said binary distribution function F(x); and

reconstituting '1' or '0' from ith digital watermark data w_i if $F(k_i) > \propto$, reconstituting '0' or '1' from ith digital watermark data w_i if $1-F(k_i) > \propto$, and determining that there is no watermark data or the presence is unknown if both of $F(k_i) > \propto$ and $1-F(k_i) > \propto$ are not satisfied.

3. ~~28.~~ (Amended) A method for reading digital watermark data embedded in digital data contents, said method comprising the steps of:

receiving said digital data contents;

determining a threshold $\propto$ of reliability of digital watermark data which is read;

obtaining a binary distribution function F(x) which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

checking whether a probability that said digital watermark sequence is digital watermark data exceeds said threshold $\propto$ by using said binary distribution function F(x); and

reconstituting digital watermark data from said digital watermark sequence by using majority decision processing if said probability exceeds $\propto$, and determining that there is no watermark data or the presence is unknown if said probability does not exceed $\propto$.

5. ~~30.~~ (Amended) The method as claimed in claim ~~26~~, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said method further comprising the steps of:

demodulating said digital watermark sequence by said pseudo-random sequence; and

reconstituting digital watermark data from said demodulated digital watermark sequence.

6. ~~31.~~ (Amended) A method for reading digital watermark data embedded in digital data

contents, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said method comprising the steps of:

receiving said digital data contents;

determining a threshold $\propto$ of reliability of digital watermark data which is read;

obtaining a binary distribution function F(x) which represents a probability that a number of x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

demodulating said digital watermark sequence by said pseudo-random sequence;

assigning ½ to said probability q;

obtaining a maximum number x_0 which satisfies $0 \leq F(x=x_0) \leq 1-\propto$ and a minimum number x_1 which satisfies $\propto \leq (x=x_1) \leq 1$;

obtaining the number k_i of '1' or '0' included in said ith digital watermark sequence; and

reconstituting ith digital watermark data w_i as '0' or '1' if $k_i \leq x_0$, and reconstituting said ith digital watermark data w_i as '1' or '0' if $k_i \geq x_i$.

32. (Amended) A method for reading digital watermark data embedded in digital data contents; if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said method comprising the steps of:

receiving said digital data contents;

determining a threshold $\propto$ of reliability of digital watermark data which is read;

obtaining a binary distribution function F(x) which represents a probability that x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number t of embedding each bit of digital watermark data;

reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

demodulating said digital watermark sequence by said pseudo-random sequence;

A3 Cont.

assigning ½ to said probability q;

obtaining x_0 or x_1 which satisfies $0 \leq F(x=x_0) \leq 1-\propto$ or $\propto \leq (x=x_1) \leq 1$;

determining whether a value is equal to or less than x_0 or equal to or more than x_1, said value being a mean value of absolute values of a difference between the number of '0' or '1' included in said ith digital watermark sequence and a central value q X t of a binary distribution;

reconstituting digital watermark data by performing majority decision processing for said ith digital watermark sequence if said value is equal to or less than x_0 or equal to or more than x_1; and

determining that there is no digital watermark data or the presence is unknown if said value is not equal to or less than x_0 or equal to or more than x_1.

A4

9 ~~35~~. (Amended) An apparatus for reading digital watermark data embedded in digital data contents, said apparatus comprising;

means for receiving said digital data contents;

means for obtaining a binary distribution function F(x) which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for calculating the number k_i of '1' or '0' included in said digital watermark sequence;

means for calculating a probability $F(k_i)$ by using said binary distribution function F(x); and

means for reconstituting '1' or '0' from ith digital watermark data w_i if $F(k_i) > \propto$, reconstituting '0' or '1' from ith digital watermark data w_i if $1-F(k_i)>\propto$, and,
determining that there is no watermark data or the presence is unknown if both of $F(k_i)>\propto$ and $1-F(k_i)>\propto$ are not satisfied, $\propto$ being a threshold of reliability of digital watermark data which is read.

A5

11. ~~37~~. (Amended) An apparatus for reading digital watermark data embedded in digital

A5 Concl.

data contents, said apparatus comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function F(x) which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for checking whether a probability that said digital watermark sequence is digital watermark data exceeds said threshold $\propto$ by using said binary distribution function F(x), $\propto$ being a threshold of reliability of digital watermark data which is read; and

means for reconstituting and generating digital watermark data from said digital watermark sequence by using majority decision processing if said probability exceeds $\propto$, and, determining that there is no watermark data or the presence is unknown if said probability does not exceed $\propto$.

A6

13. ~~39~~. (Amended) The apparatus as claimed in claim ~~35~~ 1, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said apparatus further comprising:

means for demodulating said digital watermark sequence by said pseudo-random sequence; and

means for reconstituting digital watermark data from said demodulated digital watermark sequence.

14 ~~40~~. (Amended) An apparatus for reading digital watermark data embedded in digital data contents, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said apparatus comprising:

means for receiving said digital data contents:

means for obtaining a binary distribution function F(x) which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding

each bit of digital watermark data;

A6 Continued

means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for demodulating said digital watermark sequence by said pseudo-random sequence;

means for assigning ½ to said probability q;

means for obtaining a maximum number x_0 which satisfies $0 \leq F(x=x_0) \leq 1-\propto$ and a minimum number x_1 which satisfies $\propto \leq F(x=x_1) \leq 1$, $\propto$ being a threshold of reliability of digital watermark data which is read;

means for obtaining the number k_i of '1' or '0' included in said ith digital watermark sequence; and

means for reconstituting ith digital watermark data w_i as '0' or '1' if $k_i \leq x_0$, and, reconstituting said ith digital watermark data w_i as '1' or '0' if $k_i \geq x_1$.

15. ~~41.~~ (Amended) An apparatus for reading digital watermark data embedded in digital data contents:, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said apparatus comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function F(x) which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number t of embedding each bit of digital watermark data;

means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for demodulating said digital watermark sequence by said pseudo-random sequence;

means for assigning ½ to said probability q;

means for obtaining x_0 or x_1 which satisfies $0 \leq F(x=x_0) \leq 1-\propto$ or $\propto \leq F(x=x_1) \leq 1$, $\propto$ being a threshold of reliability of digital watermark data which is read;

means for determining whether a value is equal to or less than x_0 or equal to or more than x_1, said value being a mean value of absolute values of a difference between the number of '0' or '1' included in said ith digital watermark sequence and a central value q X t of a

A9 Cont'd

binary distribution;

means for reconstituting digital watermark data by performing majority decision processing for said ith digital watermark sequence if said value is equal to or less than x_0 or equal to or more than x_1; and

means for determining that there is no digital watermark data or the presence is unknown if said value is not equal to or less than x_0 or equal to or more than x_1.

A7

17. (Amended) An integrated circuit for reading digital watermark data embedded in digital data contents, said integrated circuit comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function F(x) which represents a probability that a number x of '1' bits or '0" bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for calculating the number k_i of '1' or '0' included in said digital watermark sequence;

means for calculating a probability $F(k_i)$ by using said binary distribution function F(x); and

means for reconstituting '1' or '0' from ith digital watermark data w_i if $F(k_i)>\propto$, reconstituting '0' or '1' from ith digital watermark data w_i if $1-F(k_i)>\propto$, and determining that there is no watermark data or the presence is unknown if both of $F(k_i)>\propto$ and $1-F(k_i)>\propto$ are not satisfied, $\propto$ being a threshold of reliability of digital watermark data which is read.

A8

19. (Amended) An integrated circuit for readinq digital watermark data embedded in digital_data contents, said integrated circuit comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function F(x) which represents a probability that a number of x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of

A8 Concl.

embedding each bit of digital watermark data;

means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for checking whether a probability that said digital watermark sequence is digital watermark data exceeds said threshold a by using said binary distribution function F(x), $\propto$ being a threshold of reliability of digital watermark data which is read; and

means for reconstituting and generating digital watermark data from said digital watermark sequence by using majority decision processing if said probability exceeds $\propto$, and, determining that there is no watermark data or the presence is unknown if said probability does not exceed $\propto$.

A9

21. ~~18~~. (Amended) The integrated circuit as claimed in claim ~~14~~ 17, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said integrated circuit further comprising:

means for demodulating said digital watermark sequence by said pseudo-random sequence; and

means for reconstituting digital watermark data from said demodulated digital watermark sequence.

22. ~~19~~. (Amended) An integrated circuit for reading digital watermark data embedded in digital data contents, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said integrated circuit comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function. F(x) which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for demodulating said digital watermark sequence by said pseudo-random sequence;

means for assigning ½ to said probability q;

means for obtaining a maximum number x_0 which satisfies $0 \leq F(x=x_0) \leq 1-\propto$ and a minimum number x_1 which satisfies a $\propto \leq F(x=x_1) \leq 1$, $\propto$ being a threshold of reliability of digital watermark data which is read; and

means for obtaining the number k_i of '1' or '0' included in said ith digital watermark sequence;

means for reconstituting ith digital watermark data w_i as '0' or '1' if $k_i \leq x_0$, and, reconstituting said ith digital watermark data w_i as '1' or '0' if $k_i \leq x_1$.

23 ~~30~~. (Amended) An integrated circuit for reading digital watermark data embedded in digital data contents, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said integrated circuit comprising:

means for receiving said digital data contents;

means for obtaining a binary distribution function F(x) which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number t of embedding each bit of digital watermark data;

means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

means for demodulating said digital watermark sequence by said pseudo-random sequence;

means for assigning ½ to said probability q;

means for obtaining x_0 or x_1 which satisfies $0 \leq F(x=x_0) \leq 1-\propto$ or $\propto \leq F(x=x_1) \leq 1$, $\propto$ being a threshold of reliability of digital watermark data which is read;

means for determining whether a value is equal to or less than x_0 or equal to or more than x_1, said value being a mean value of absolute values of a difference between the number of '0' or '1' included in said ith digital watermark sequence and a central value q X t of a binary distribution;

means for reconstituting digital watermark data by performing majority decision processing for said ith digital watermark sequence if said value is equal to or less than x_0 or equal to or more than x_1; and

means for determining that there is no digital watermark data or the presence is unknown if said value is not equal to or less than x_0 or equal to or more than x_1.

A 10 25 53. (Amended) A computer readable medium storing program code for causing a computer system to read digital watermark data embedded in digital data contents, said computer readable medium comprising:

program code means for receiving said digital data contents;

program code means for obtaining a binary distribution function F(x) which represents a probability that a number x of '1' bits or '0' bits are included in a bi: sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability a of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

program code means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

program code means for calculating the number k_i of '1' or '0' included in said digital watermark sequence; and

program code means for calculating a probability $F(k_i)$ by using said binary distribution function F(x);

program code means for reconstituting '1' or '0' from ith digital watermark data w_i if $F(k_i) > \propto$, reconstituting '0' or '1' from ith digital watermark data w_i if $1-F(k_i) > \propto$, and, determining that there is no watermark data or the presence is unknown if both of $F(k_i) > \propto$ and $1-F(k_i) > \propto$ are not satisfied, $\propto$ being a threshold of reliability of digital watermark data which is read.

A 11 27 55. (Amended) A computer readable medium storing program code for causing a computer system to read digital watermark data embedded in digital data contents, said computer readable medium comprising:

program code means for receiving said digital data contents;

program code means for obtaining a binary distribution function F(x) which represents a probability that a number x of '1' bits or '0' bits are included in a bi: sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability a of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

program code means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

A 11 Cancel.

program code means for checking whether a probability that said digital watermark sequence is digital watermark data exceeds said threshold $\propto$ by rising said binary distribution function F(x), $\propto$ being a threshold of reliability of digital watermark data which is read; and

program code means for reconstituting and generating digital watermark data from said digital watermark sequence by using majority decision processing if said probability exceeds $\propto$, and determining that there is no watermark data or the presence is unknown if said probability does not exceed $\propto$.

A 10

29~~57~~. (Amended) The computer readable medium as claimed in claim 25 ~~53~~, if a data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said computer readable medium further comprising:

program code means for demodulating said digital watermark sequence by said pseudo-random sequence; and

program code means for reconstituting digital watermark data from said demodulated digital watermark sequence.

30~~58~~. (Amended) A computer readable medium storing program code for causing a computer system to read digital watermark data embedded in digital data contents, if data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said computer readable medium comprising:

program code means for receiving said digital data contents;

program code means for obtaining a binary distribution function. F(x) which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number of embedding each bit of digital watermark data;

program code means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

program code means for demodulating said digital watermark sequence by said pseudo-random sequence;

program code means for assigning ½ to said probability q;

program code means for obtaining a maximum number x_0 which satisfies $0 \leq F(x=x_0) \leq 1-\propto$ and a minimum number x_1 which satisfies $a \propto \leq F(x=x_1) \leq 1$, $\propto$ being a

A12 Cont.

threshold of reliability of digital watermark data which is read; and

program code means for obtaining the number k_i of '1' or '0' included in said ith digital watermark sequence;

program code means for reconstituting ith digital watermark data w_i as '0' or '1' if $k_i \leq x_0$, and, reconstituting said ith digital watermark data w_i as '1' or '0' if $k_i \leq x_1$.

31 ~~59~~. (Amended) A computer readable medium storing program code for causing a computer system to read digital watermark data embedded in digital data contents, if data sequence which is embedded as said digital watermark data is modulated by a pseudo-random sequence, said computer readable medium comprising:

program code means for receiving said digital data contents;

program code means for obtaining a binary distribution function F(x) which represents a probability that a number x of '1' bits or '0' bits are included in a bit sequence which is read at random from digital data contents, said binary distribution function F(x) being obtained by using a probability q of reading '1' or '0' in said bit sequence and a repeating number t of embedding each bit of digital watermark data;

program code means for reading an ith digital watermark sequence of said digital watermark data from a digital watermark area of said digital data contents;

program code means for demodulating said digital watermark sequence by said pseudo-random sequence;

program code means for assigning ½ to said probability q;

program code means for obtaining x_0 or x_1 which satisfies $0 \leq F(x=x_0) \leq 1-\propto$ or $\propto \leq F(x=x_1) \leq 1$, $\propto$ being a threshold of reliability of digital watermark data which is read;

program code means for determining whether a value is equal to or less than x_0 or equal to or more than x_1, said value being a mean value of absolute values of a difference between the number of '0' or '1' included in said ith digital watermark sequence and a central value q X t of a binary distribution;

program code means for reconstituting digital watermark data by performing majority decision processing for said ith digital watermark sequence if said value is equal to or less than x_0 or equal to or more than x_1; and

program code means for determining that there is no digital watermark data or the presence is unknown if said value is not equal to or less than x_0 or equal to or more than x_1.